

**BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET NO. E-2, SUB 1142**

**In the Matter of)
Application of Duke Energy Progress,)
LLC for Adjustment of Rates and)
Charges Applicable to Electric Service)
in North Carolina)**

**DIRECT TESTIMONY OF
MICHAEL MURRAY
ON BEHALF OF
NORTH CAROLINA SUSTAINABLE ENERGY ASSOCIATION**

Table of Contents

I. Introduction	1
II. Access to Energy Use Data	16
A. Access to Energy Usage Data with Some Delay (as Opposed to Real-Time)	17
B. Access to Real-Time Energy Usage Data	32
III. Access to Billing Data.....	39
IV. Access to Utility Rate Data	44
V. Ease of Use and the Customer Authorization Process.....	46
VI. Security and Privacy	49

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, TITLE, AND BUSINESS ADDRESS.

A. My name is Michael Murray. I am President of the Mission:data Coalition (“Mission:data”). My business address is 1752 NW Market Street #1513, Seattle, WA 98107.

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL BACKGROUND AND YOUR RELEVANT PROFESSIONAL EXPERIENCE.

A. I co-founded Mission:data in 2013 and have led our efforts to intervene at public utility commissions in 14 states as well as the District of Columbia on issues of advanced meters, data privacy, and the benefits to ratepayers of electronic access to energy usage data. Prior to Mission:data, I led an unincorporated coalition of innovative companies called the Open Energy Network that in 2012-2013 intervened at the California Public Utilities Commission to successfully institute the first state-wide implementation of Green Button Connect My Data, further described below.

Since 2012, I have authored publications and presented at conferences on the value of energy usage data for energy efficiency purposes. I recently published two major reports, one titled “Got Data? The Value of Energy Data Access to Consumers” which includes an analysis of state policies governing access to advanced meter data, and “New Smart Meter Policies Yielding Data (and Savings) for End Users,” published November, 2016 in the journal *Natural Gas & Electricity*. I have presented at dozens of conferences on state

1 developments in energy data access. In 2012, I presented at the White House with
2 former Secretary of Energy Steven Chu and former U.S. Chief Technology
3 Officer Aneesh Chopra on Green Button.

4 I began my career in 2004 as co-founder and CEO of Lucid, an energy
5 management software company for commercial buildings, where I grew the
6 company from zero to over 40 employees, raised \$10 million in venture capital
7 and recruited board members from Apple, Intuit, and Bear Stearns. Lucid offers a
8 cloud-based service that analyzes real-time meter data from thousands of
9 commercial buildings across North America to support energy efficiency. Lucid's
10 customers include over 350 organizations such as Google, Starbucks Coffee, all
11 eight Ivy League universities, and others. I hold two U.S. patents relating to
12 energy data collection, sharing, and analysis, #8,176,095 and #8,375,068. I earned
13 a B.A. with highest honors from Oberlin College in 2004.

14 **Q. ON WHOSE BEHALF ARE YOU FILING THIS ANSWER TESTIMONY?**

15 A. I am filing this testimony on behalf of North Carolina Sustainable Energy
16 Association ("NCSEA"), an intervenor in this case.

17 **Q. WHAT IS THE MISSION:DATA COALITION?**

18 A. The Mission:data Coalition, a non-profit organization, is national coalition of
19 more than 35 technology companies delivering consumer-focused, data-enabled
20 energy savings for homes and businesses. The exciting industry our companies
21 represent is based on advances in computational capability that did not exist a
22 decade ago. For the residential sector, the real game changer is the availability of

1 continuous energy usage information made available by Advanced Metering
2 Infrastructure (“AMI”). Our members – with sales in excess of \$1 billion per year
3 – have developed innovative services leveraging advanced meter and utility bill
4 data that benefit consumers and utilities. Our companies are focused on bringing
5 energy efficiency solutions to a national market. To realize that objective, it is
6 vital that we empower consumers with convenient access to their own energy data
7 in a consistent manner from state to state. Mission:data works with industry and
8 policymakers to advance customers’ ability to quickly and conveniently share
9 their meter data with energy management companies of their choice. More
10 information about Mission:data is available on our website at
11 www.missiondata.org.

12 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

13 A. Duke Energy Progress (“DEP” or “the Company”) seeks to deploy AMI. The
14 deployment of AMI offers significant operational benefits for utilities and the
15 potential for significant energy savings for consumers. Between 33% and 66% of
16 the total potential benefits of AMI may be customer benefits, as I explain below.
17 A major lesson from prior state deployments of AMI is that full realization of
18 consumer benefits from efficiency or time-shifting of usage will not occur unless
19 consumers have convenient access to their own energy data made available by
20 advanced meters. It is also critical that such policies are timely and consistently
21 implemented. I am making recommendations to ensure that consumers receive
22 their share of the benefits of AMI – specifically, access to the energy data

1 generated by advanced meters, along with accompanying cost information, as
2 further described below. My objective is to provide guidance on the specific steps
3 that must be undertaken so that these consumer benefits are fully realized for
4 DEP's customers.

5 **Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS.**

6 A. Customers pay for the full cost of AMI in rates, so I recommend that utilities
7 should adopt certain best practices in order to enable customers to obtain the full
8 potential of energy savings that can be obtained with AMI. To ensure that DEP's
9 customers have convenient and secure access to new data-enabled technologies
10 and services to help them save energy and money, and otherwise realize value
11 from the AMI deployment, I recommend several steps:

12 **1. Provide consumers easy access to the best available**
13 **information about their energy usage through two interfaces.** These
14 interfaces include (i) energy usage information transmitted through the
15 Company's Field Area Network ("FAN") and back to the Company's
16 information technology systems and provided to the consumer and
17 authorized third parties via the utility's information technology ("IT")
18 systems; and (ii) real-time information directly from the Home Area
19 Network ("HAN") radio in the advanced meter to a device controlled by
20 the consumer.

21 To promote competitive markets for "behind the meter" services,
22 the data collected by advanced meters should be provided in a

1 standardized protocol in order to support innovative new technologies, as
2 a component of basic utility service. Meter data transmitted through the
3 FAN should be provided to the consumer via the Green Button Connect
4 My Data standard, further described below. The HAN radio contained in
5 each meter should be enabled as meters are deployed so that customers
6 can experience immediate, tangible benefits. The Company should provide
7 a “Bring Your Own Device” (“BYOD”) offering to allow customers to
8 easily connect any HAN-compatible device to the advanced meter.

9 **2. Provide customers and authorized third parties with access to**
10 **historic billing information in a machine-readable, automated**
11 **manner.** Access to billing data is important so that new digital services
12 can provide information to consumers on the exact bill impacts of their
13 energy decisions. Historical bills should also be able to be transmitted
14 directly from the utility to any authorized third party electronically via a
15 standardized XML format.

16 **3. Provide consumers and third parties with rate information in**
17 **standardized, machine-readable formats.** Utility rate schedules should
18 be published in standardized, machine-readable forms because it allows
19 new technologies across the U.S. to easily calculate the bill impacts of
20 certain decisions regarding energy efficiency or other distributed energy
21 resources. Most people care about dollars, not kilowatt-hours. Providing
22 innovative companies with access to the Company’s approved rates in a

1 standardized, machine-readable format, maintained in a centralized
2 database, is important because it takes human beings out of the cost-
3 calculation process and lets software do the work, regardless of how
4 complex rates may become. The Commission should require DEP to
5 maintain accurate and up-to-date rates in the National Renewable Energy
6 Laboratory's Utility Rate Database so that software applications can easily
7 convert kilowatt-hours into dollars and present customers with accurate
8 options for cost-saving measures.

9 **4. The customer authorization process should be easy for**
10 **consumers to use and require the least number of steps.** Signing up for
11 third party energy management services should be easy, like downloading
12 a smartphone "app." By simplifying the user experience online and
13 minimizing the number of customer actions required, i.e. the reducing the
14 number of clicks, the Company can ensure that its customers can
15 immediately gain additional value from their advanced meter with
16 numerous software applications now available on the market, which I
17 further describe below. Customer authorization processes that require
18 many inputs from customers or that require many steps will result in
19 significantly less adoption of data-enabled energy management services
20 and fewer benefits for consumers from the AMI investment.

21 **Q. IS DEP SEEKING APPROVAL TO RECOVER COSTS OF AMI**
22 **DEPLOYMENT IN THIS CASE?**

1 A. No. Company witness Mr. Robert M. Simpson states that AMI deployment costs
2 are not included in DEP's application.¹ However, Company witness Ms. Laura A.
3 Bateman states that the Company is requesting permission to establish a
4 regulatory asset account for meters deployed under its AMI program.²

5 **Q. WHY DO YOU BELIEVE YOUR RECOMMENDATIONS ARE TIMELY?**

6 A. I believe my recommendations are timely because DEP seeks to embark on two
7 large infrastructure projects that directly affect customers' ability to manage their
8 energy use with detailed consumption data: AMI deployment and a Customer
9 Information System ("CIS"). The Company states that AMI is expected to cost
10 approximately \$276.4 million and the CIS cost related to AMI is expected to be
11 approximately \$20.4 million.³ These investments can, if built with energy
12 information applications in mind, be "future-proof" and facilitate customer
13 benefits for a long period of time. However, if DEP embarks on an expensive
14 information technology upgrade without accommodating my recommendations,
15 then it will be much more difficult and costly to make such changes in the future.

16 **Q. HAS MISSION:DATA HELPED DEVELOP DATA ACCESS POLICIES IN**
17 **OTHER STATES?**

18 A. Yes. Mission:data, which focuses on empowering consumers with convenient,
19 easy access to their energy data, has engaged in more than a dozen states across
20 the country and offers experience on lessons learned, from which North Carolina
21 can benefit. Mission:data has filed comments or otherwise provided information

¹ Direct Testimony of Robert M. Simpson III, p. 31.

² Direct Testimony of Laura A. Bateman, p. 19.

³ Direct Testimony of Robert M. Simpson III, p. 29.

1 for proceedings in the following states: Arizona, California, Colorado, Illinois,
2 Maryland, Massachusetts, Michigan, Minnesota, New York, Ohio, Pennsylvania,
3 and Texas, as well as the District of Columbia. Copies of our comments or other
4 filings are available on our website.⁴

5 **Q. WHY IS ACCESS TO ENERGY DATA IMPORTANT FOR HELPING**
6 **CONSUMERS SAVE ENERGY?**

7 A. The opportunity for consumers to save energy and save money with advanced
8 meter data is based on advances in computational capability that did not exist a
9 decade ago. With energy efficiency efforts, one fundamental problem has been
10 the expense of evaluating the amount of energy wasted by a home or building and
11 identifying appropriate steps to reduce that waste. In the industrial and large
12 commercial sectors, the amounts of energy consumed are large enough to justify
13 significant investments in customer-owned submeters on electric circuits and IT
14 systems to analyze energy use (even though those investments are often
15 unnecessary because the utility's advanced meters collect the same information).
16 However, in the residential sector, loads are much smaller and more diverse,
17 meaning that efficiency solutions that depend on usage data have been severely
18 limited up until recently because of a multi-hundred-dollar cost per home in
19 metering equipment, communications systems, and installation is necessary when
20 advanced meter data are not easily accessible.

4 See www.missiondata.org/activities.

1 A real opportunity in the residential sector is the availability of continuous
2 energy usage information in a secure, standard electronic format made available
3 by AMI. Energy usage patterns vary greatly across households – very few homes
4 are alike. A detailed analysis of each home’s use opens the door to tailored and
5 highly effective strategies for managing energy use and helping consumers save
6 money. Research and experience in other states shows that energy conservation
7 solutions that use granular and real-time data generate bill savings more
8 effectively and in many instances can cost ratepayers significantly less than
9 traditional energy efficiency programs.

10 **Q. WHAT ARE THE BENEFITS TO NORTH CAROLINA OF USING**
11 **PROVEN TECHNOLOGY STANDARDS DEVELOPED FOR A**
12 **NATIONAL MARKET?**

13 A. A vibrant, competitive national marketplace is developing to take advantage of
14 consumers having access to their own usage data and the ability to share that data
15 with energy management providers, also known as “third parties,” of their choice.
16 In the past, many energy efficiency solutions were required to be tailored to each
17 utility – essentially, to accommodate utilities’ idiosyncrasies. With over 3,000
18 utilities across the country, an approach that focuses on unique solutions for
19 individual utilities results in a balkanized, fragmented market that fails to take
20 advantage of the economies of scale enabled by software and inexpensive
21 computing power. Thus, the kind of Internet-based consumer innovation that has
22 transformed mobile communications is largely absent in the electricity sector.

1 To realize timely, tangible consumer benefits from AMI deployments, it is
2 important to undertake several specific steps to provide consumers with
3 convenient, reliable and secure access to their own data. Four states – Illinois,
4 Texas, California, and most recently New York – have led the way in
5 empowering consumers with such access on a statewide basis. These states
6 represent a total market of over 31 million data-enabled AMI meters – almost half
7 of the 70 million advanced meters deployed (or soon to be deployed) nationwide.⁵
8 Maryland is also considering whether to implement these “best practices”
9 statewide.⁶ In two other states – Colorado and New Jersey – the Commissions
10 have approved settlements in which the utilities (Xcel Energy and Rockland
11 Electric Company) have agreed to adopt data access policies, covering an
12 additional 1.5 million meters. In addition to leading the development of a national
13 market for low-cost energy management offerings, I believe that the
14 aforementioned states provide valuable lessons from which North Carolina can
15 learn, namely how best to leverage AMI to help consumers save money, spur
16 adoption of clean energy resources, including energy efficiency, and enhance the
17 state’s technology leadership and economic growth. I discuss later in my
18 testimony specific standards that should be adopted to ensure maximum value
19 from DEP’s AMI investments.

⁵ Adam Cooper, *Electric Company Smart Meter Deployments: Foundation for A Smart Grid*, Edison Foundation Institute for Electric Innovation, September 2016, p. 2.

⁶ Maryland Public Service Commission, Public Conference 44. Staff report from the competitive markets and customer choice workgroup (June 30, 2017), available at http://webapp.psc.state.md.us/newIntranet/AdminDocket/NewIndex3_VOpenFile.cfm?ServerFilePath=C%3A%5CAdminDocket%5CPublicConferences%5CPC44%5C65%2Epdf

1 **Q. PLEASE DESCRIBE THE BENEFITS OF CONSUMER DATA ACCESS**
2 **ENABLED BY ADVANCED METERING FOR CONSUMERS AND**
3 **STATES.**

4 A. The initial results from other states are very promising and impressive. Data-
5 driven energy savings generated by third party energy management solutions can
6 save consumers between 6% and 18% of their energy use.⁷ In one example in
7 California, energy management technologies are cutting up to \$20 per month or
8 more off residential utility bills.⁸ Adjusted to the average North Carolina rate for
9 residential customers of 11.28 cents/kWh, that would equate to \$13.28 per month
10 bill savings.⁹ Adjusted to the average residential DEP rate proposed in this
11 proceeding of 12.12 cents/kWh, it would equate to \$14.27 per month bill
12 savings.¹⁰ Companies are developing low-cost, innovative ways of engaging
13 consumers, such as a new service that helps parents direct monthly bill savings to
14 tax-deferred college savings accounts for their children.¹¹

15 Harnessing competitive market forces for informational services can
16 provide consumers with many more choices of offerings and yield energy savings
17 much more cost-effectively than traditional efficiency programs, thus avoiding

⁷ Michael Murray and Jim Hawley, *Got Data? The Value of Energy Data Access to Consumers*, Mission:data Coalition and More Than Smart (2016), available at <http://www.missiondata.org/s/Got-Data-value-of-energy-data-access-to-consumers.pdf>.

⁸ See, e.g., http://www.wattzon.com/wp-content/uploads/2016/07/PartnerStudy_Livermore_061015.pdf.

⁹ Average residential electric rates in North Carolina were 11.28 ¢/kWh, and California was 18.68 ¢/kWh in 2015. See EIA Electric Power Monthly, Table 5.6.A, Average Price of Electricity to Ultimate Customers by End-Use Sector by State.

¹⁰ Derived from Proposed Residential Service Schedule Schedule RES-45, Application Exhibit B, p. 2-3.

¹¹ See, e.g., <http://www.wattzon.com/news/clinton/>.

1 ratepayer subsidies for duplicative programs and technologies. In one case,
2 analytical software created weekly energy reports with individualized
3 recommendations utilizing 60-minute usage data delivered energy savings
4 averaging more than 5% across all participating households – comparable to those
5 delivered by a traditional non-targeted efficiency program investing in equipment
6 and structural retrofits – at 1/25th of the cost.¹²

7 **Q. IS IT POSSIBLE TO QUANTIFY THE CONSUMER BENEFITS OF BILL**
8 **SAVINGS DUE TO ENERGY EFFICIENCY RESULTING FROM**
9 **ADVANCED METERING AND DATA ENABLEMENT?**

10 A. Yes. Several utilities in other states have provided estimates for their AMI
11 investments. In 2007, Southern California Edison Company (“SCE”) submitted its
12 application for AMI. In that case, operational benefits alone were not sufficient to
13 fully offset the costs of five million AMI meters. SCE worked with the
14 California’s Office of Ratepayer Advocates to develop estimates of consumer
15 benefits and determined that, overall, consumer benefits would total about \$816
16 million, compared to operational benefits of approximately \$1.1 billion. As for
17 consumer conservation benefits specifically, SCE estimated a minimum of \$164
18 million in benefits. To reach this estimate, SCE made a number of assumptions
19 regarding residential consumer adoption of both real-time information feedback
20 technology and historical information provided through SCE’s website.¹³ SCE

¹² *Energy Upgrade Mountain View Final Report*, p. 3, City of Mountain View, Acterra and Home Energy Analytics (January 2015), available at <http://corp.heca.com/results/>.

¹³ For example, SCE assumed residential customers who adopt real-time technology can achieve a 6.5% reduction in energy consumption; 10% of new homes constructed in their territory will be

1 anticipated residential customers that use interval data provided through their
2 website can achieve a 2% reduction in their energy consumption.¹⁴ Unfortunately,
3 SCE implemented Green Button Connect My Data and the HAN years behind
4 schedule, a mistake North Carolina can avoid. As a result, the benefits projected
5 by SCE were not realized in the early years of AMI deployment.

6 Ameren Illinois Company also quantified the consumer benefits of energy
7 savings as a result of enhanced access to information made possible with AMI.
8 Ameren, a utility with 1.5 million customers, calculated the benefit of energy
9 efficiency stemming from AMI to be \$23.7 million.¹⁵

10 Industry is continuing to develop more effective methods of engaging
11 consumers and studies suggest that savings of similar magnitudes can be
12 achieved. I believe that estimates based on this type of methodology offer a
13 reasonable basis to quantify the consumer-side benefits of AMI, with the
14 important proviso that standards-based data access via the two interfaces I have
15 discussed is promptly implemented by the Company.

16 **Q. IS IT REASONABLE FOR UTILITIES TO ADOPT DATA ACCESS**
17 **“BEST PRACTICES” TO ENABLE CUSTOMERS TO OBTAIN THE**
18 **FULL ENERGY SAVINGS RELATED TO AMI DEPLOYMENTS?**

equipped with in-home displays with real-time data; existing homes will have an initial adoption rate of 0.5% and an annual growth rate of 0.05% for in-home graphical displays. SCE also assumed computer-based graphical displays using near real-time data would have a 1% initial market penetration with an additional 1% of growth each year thereafter.

¹⁴ Opening Brief of Southern California Edison Company (U 338-E), p. 3, California Public Utilities Commission Docket No. A.07-07-026 (April 4, 2008) (in support of settlement agreement with Office of Ratepayer Advocates and others regarding SCE AMI deployment). For assumptions regarding adoption rates, see settlement agreement, p. A-1 filed in the same docket.

¹⁵ Direct Testimony on Rerearing of Dr. Ahmad Faruqi. Illinois Commerce Commission Docket No. 12-0244, Ameren Exhibit 5.6RH (June 28, 2012).

1 A. Yes. Customers pay for the full cost of AMI in rates, so utilities should adopt data
2 access “best practices” to enable customers to obtain the full potential of energy
3 savings that can be obtained with AMI. Several independent studies have
4 validated the notion that consumer energy savings can be quantified and achieved
5 in an AMI deployment. A report from the Edison Foundation’s Institute for
6 Electric Efficiency (“IEE”) found that consumer bill savings, either from load-
7 shifting or conservation as a result of the information provided by AMI, account
8 for 33% of total AMI benefits for a hypothetical “cautious” utility and 66% of
9 total AMI benefits for a hypothetical “pioneer” utility.¹⁶

10 In addition, a guidebook for cost benefit analysis published by the Electric
11 Power Research Institute (“EPRI”) in 2012 states that quantifying consumer
12 benefits is necessary because it is such a large potential value. EPRI writes that,
13 while calculating consumer benefits can be complex,

14 . . . a large part of the value of some Smart Grid investments is
15 derived from other technologies whose use they enable. Assessing
16 the value of Smart Grid investment must address the functions it
17 enables, as well as the value that it provides directly.¹⁷

18 DEP should strive to provide customers with the full range of benefits
19 associated with AMI, even though the exact value may not be certain.
20 Unassailable confidence is not the standard by which any utility should
21 incorporate potential benefits in its analysis.

¹⁶ Ahmad Faruqui et al., *The Costs and Benefits of Smart Meters for Residential Consumers*, p. 27, The Institute for Electrical Efficiency, The Edison Foundation (July 2011).

¹⁷ *Guidebook for Cost/Benefit Analysis of Smart Grid Demonstration Projects: Revision 1, Measuring Impacts and Monetizing Benefits*, Electric Power Research Institute (2012), available at <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001025734>.

1 By providing customers with data access, DEP can achieve not only
2 energy efficiency savings but also peak demand savings. Many researchers have
3 studied the conservation impacts of time-shifting behaviors on the part of
4 consumers. One notable study in *Public Utilities Fortnightly* considered whether
5 efficiency and demand response were “twins, siblings or [merely] cousins.” The
6 authors found an average 4.0% conservation effect as a result of dynamic pricing
7 across 23 different utilities. Long-term conservation effects were found even
8 though dynamic pricing was intended to address only certain peak hours – likely
9 because consumer habits inevitably bleed into off-peak times.¹⁸ The causal factor
10 of bill savings – enhanced information and pricing signals that change consumer
11 behavior – can be attained through both efficiency and demand savings.

12 **Q. WHAT IS YOUR ESTIMATE OF THE MAGNITUDE OF THE**
13 **CUSTOMER ENERGY SAVINGS AND PEAK DEMAND SAVINGS THAT**
14 **DUKE ENERGY CAN OBTAIN BY ADOPTING DATA ACCESS “BEST**
15 **PRACTICES”?**

16 A. I cannot conduct a rigorous analysis because I lack information such as the
17 appropriate market segmentation data of the Company’s customer base. However,
18 it is possible, and appropriate, to broadly apply the findings from other studies to
19 DEP in order to see that the benefit could be very significant and deserves further
20 consideration.

¹⁸ Chris King and Dan Delurey, *Twins, Siblings or Cousins? Analyzing the conservation effects of demand response programs*, PUBLIC UTILITIES FORTNIGHTLY, pp. 54-61 (March 2005).

1 A valuable reference point is the IEE analysis mentioned previously which
2 estimated a customer efficiency benefit of \$100 per customer for a “cautious”
3 utility and an efficiency benefit of \$150 per customer for a “pioneer” utility over a
4 20-year time horizon. Assuming DEP has 1.3 million residential electricity
5 customers in North Carolina, the magnitude of projected customer benefits from
6 data access would be approximately \$130 million to \$195 million.¹⁹

7 Ameren’s potential customer efficiency benefit of \$23.7 million was
8 derived from the IEE analysis but with different assumptions on customer
9 segmentation, time-of-use rates, and other variables.²⁰ Again, I cannot say which
10 analysis is more accurate or appropriate for DEP. But the potential magnitude is
11 quite large. My recommendation is that the Commission require the Company to
12 thoroughly examine customer benefits of energy savings using the methodologies
13 demonstrated in the literature I have cited.

14 **II. ACCESS TO ENERGY USE DATA**

15 **Q. PLEASE DESCRIBE YOUR FIRST RECOMMENDATION THAT DEP**
16 **SHOULD PROVIDE CUSTOMERS AND AUTHORIZED THIRD**
17 **PARTIES WITH BOTH HISTORIC AND REAL-TIME ENERGY USAGE**
18 **INFORMATION.**

19 **A.** There are two distinct interfaces by which utilities can provide customer energy
20 usage data to customers for their own use. First, historic interval data collected by
21 the meter and transmitted through the utility’s FAN should be made available to

¹⁹ Ahmad Faruqui et al. (2011), p. 27.

²⁰ *Ibid.*, p. 11.

1 consumers and authorized third parties as soon as possible after it is collected by
2 the utility. Energy usage data should be provided through a nationally
3 standardized and automated method, “Green Button Connect My Data” (“GBC”),
4 also known by its technical name, the Energy Services Provider Interface or the
5 North American Energy Standard Board’s (“NAESB”) REQ.21. A principal
6 advantage of GBC is that consumers can automatically transmit data to third
7 parties without having to purchase equipment for their home or building. Energy
8 usage data is typically provided after some delay to the consumer’s authorized
9 third party because it must go through the utility’s FAN and IT infrastructure.
10 Second, real-time data should be provided through the HAN radio contained in
11 the advanced meter and transmitted directly to a device on-site owned by the
12 consumer, typically called a “gateway,” in-home display or other device capable
13 of receiving the signal from the meter. Real-time data access can unlock a host of
14 new applications and services, but only if the Company enables the HAN radio on
15 the advanced meter and makes it easy for a customer to connect their HAN device
16 with their meter.

17 **A. ACCESS TO ENERGY USAGE DATA WITH SOME DELAY**

18 **(AS OPPOSED TO REAL-TIME)**

19 **Q. WHAT IS GREEN BUTTON?**

20 A. Green Button refers to an industry-led standard, ratified by the ANSI-accredited
21 NAESB, for downloading and sharing customer usage and cost data. The standard
22 was developed by the National Institute of Standards and Technology (“NIST”)

1 and the Smart Grid Interoperability Panel. Green Button has its roots in the
2 American Recovery and Reinvestment Act of 2009 (“ARRA”), which directed the
3 Federal Communications Commission to develop a national broadband plan to
4 include digital strategies for “energy independence and efficiency.” Goal #6 of the
5 National Broadband Plan states, “To ensure that America leads in the clean
6 energy economy, every American should be able to use broadband to track and
7 manage their real-time energy consumption.”²¹

8 Federal support for the deployment of advanced meters in America
9 stemming from ARRA included the development of interoperability standards for
10 grid investments, such as customer energy usage data. NIST, as well as the Smart
11 Grid Interoperability Panel, coordinated the standard’s development over many
12 years with input from many stakeholders, including utilities. Green Button uses
13 common Internet web services methods and modern IT standards such as XML.
14 More than 50 utilities nationwide have implemented Green Button “Download
15 My Data,” a subset of the standard that is limited to the particular file containing
16 energy usage data. The complete version of the Green Button standard, GBC, has
17 been deployed by investor-owned utilities across the states of California and
18 Illinois, and in Washington, D.C. In New York, the Commission has required its
19 regulated utilities pursuing advanced metering to implement GBC, with the first
20 implementation expected by Consolidated Edison at the end of 2017. In Colorado,
21 Xcel Energy will provide GBC to all customers in 2020 as part of its AMI

²¹ *Connecting America: The National Broadband Plan*, pp. xiv-xv, Federal Communications Commission (2010), available at <https://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf>.

1 deployment. Of the 70 million advanced meters in the U.S., over 24 million
2 currently have, or will soon have, access to data via the GBC standard.

3 **Q. PLEASE EXPLAIN THE DIFFERENCE BETWEEN GREEN BUTTON**
4 **DOWNLOAD MY DATA AND GREEN BUTTON CONNECT MY DATA.**

5 A. Green Button Download My Data (“DMD”) allows customers to manually
6 download their electricity usage information in a standardized file format known
7 as XML. This file can be uploaded by a consumer to third party software
8 applications. DMD is useful, but it requires customers to manually log into their
9 utility’s website, download the Green Button XML file, and manually import it to
10 another software tool each time they want to access or use their data. DMD is
11 helpful for one-time uses, such as sending the file to a solar installer to get a price
12 quote. But DMD is too burdensome for ongoing data collection to be useful. Most
13 applications for energy efficiency require ongoing access; therefore, DMD is
14 considered very limited in terms of overall usefulness.

15 The real breakthrough, critical to enabling the kind of ongoing monitoring
16 and control that consumers expect with modern apps, is GBC. With GBC, the
17 utility hosts an automated web service through which developers of energy
18 management software can, with customer authorization, automatically and
19 securely retrieve meter data in their software. There is no need for the customer to
20 repeatedly log in to the utility’s website and download files. These authorizations
21 are valid for an agreed upon time and can be revoked at any time by the

1 consumer. The data can then be accessed and analyzed with third party software,
2 including mobile applications.

3 While the term “Green Button” can refer to both DMD and GBC, it is
4 important to understand the differences between the two. The stark contrast of
5 usefulness between DMD and GBC to utility customers was recognized by the
6 Edison Foundation in 2012. They wrote:

7 Green Button [DMD] requires customers to download their energy
8 usage data to a computer and then manually upload it to a third
9 party application. The downloading process is a barrier. As the
10 Green Button movement matures, an automation process, known
11 as “Green Button Connect My Data,” where the customer clicks a
12 button to push the data to a third-party, will become the norm.²²

13 **Q. WHAT STANDARD SHOULD BE USED FOR EXCHANGING**
14 **CUSTOMER USAGE DATA FROM THE UTILITY’S IT SYSTEMS?**

15 A. I recommend the Commission require DEP to implement GBC as part of its CIS
16 project. Any implementation of GBC should be compliant with the most current
17 NAESB standard and documented best practices. Furthermore, the Company’s
18 GBC implementation should be subjected to periodic certifications by an
19 independent third party, the Green Button Alliance, a 501(c)(3) non-profit
20 organization, to provide assurances that it is fully compliant. Some utilities across
21 the country have non-compliant DMD implementations, for example, which
22 fragments the marketplace. Finally, non-compliant implementations that do not

²² *Green Button: One Year Later*, Edison Foundation IEE Issue Brief, p. 7 (September, 2012),
available at
http://www.edisonfoundation.net/iee/Documents/IEE_Green%20Button%20Report_Final.pdf

1 pass the certification process should be promptly remedied, with penalties
2 imposed for prolonged non-compliance.

3 **Q. WHAT ARE THE CUSTOMER BENEFITS OF GREEN BUTTON**
4 **CONNECT MY DATA?**

5 A. Commercial and residential buildings make up approximately 41 percent of total
6 energy use in the U.S.²³ – the single largest energy-consuming sector. In 2010, the
7 American Council for an Energy Efficient Economy’s (“ACEEE”) review of 57
8 studies concluded that timely consumer access to granular energy data yielded
9 household energy savings of between 4% and 12% or more.²⁴ Even the more
10 modest savings identified through the use of delayed information feedback
11 approaches identified by ACEEE are significantly larger than the savings that
12 many demand-side management customer engagement strategies are attaining
13 today. As new energy efficiency services evolve and improve, potential savings
14 are likely to increase. In my 2016 report, I found an additional 12 studies beyond
15 those identified previously by ACEEE in which the savings ranged from 6% to
16 18%.

17 As an example, in Alameda and Santa Clara Counties in California, the
18 use of data-access functionality now available broadly across the state has
19 demonstrated significant household savings: a study in Alameda County found
20 electricity savings of 7.4% for electricity and 13% for natural gas, and another in

²³ U.S. Energy Information Administration, State Energy Profiles, available at
http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/rank_use_gdp.html

²⁴ Karen Ehrhardt-Martinez, Kat Donnelly, et.al., *Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities*, p. iii, American Council for an Energy Efficient Economy (June 2010).

1 Mountain View found 5.5% savings in electricity and 16.4% savings in gas – at a
2 cost per household a small fraction of the cost of traditional efficiency
3 programs.²⁵ Moreover, these gains are extremely cost-effective because data
4 analysis parses the individualized usage patterns of each building and can identify
5 targeted strategies that are the most relevant.

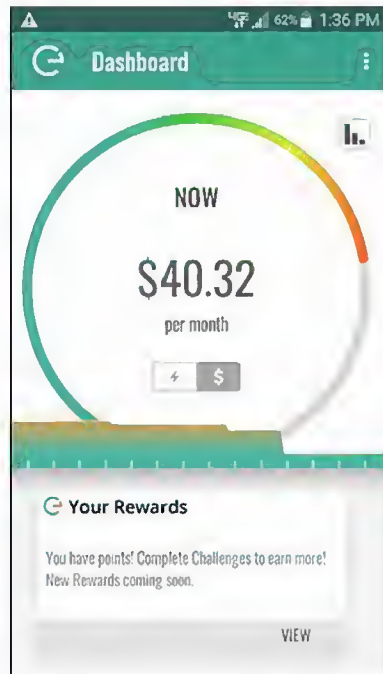
6 **Q. WHAT ARE SOME SPECIFIC EXAMPLES OF NEW PRODUCTS**
7 **ENABLED BY GREEN BUTTON CONNECT MY DATA?**

8 A. A number of companies have developed free and/or low-cost apps and software
9 offerings using GBC. Mission: data as an organization does not endorse specific
10 products, but I offer the following examples of the innovative offerings being
11 developed for consumers.

12 **Chai Basic:** Chai Basic allows the consumer to keep a close watch on
13 energy usage and costs. By collecting energy data directly from the utility, it can
14 predict the consumer's next utility bill, help track your energy savings and even
15 pay the consumer to save energy. The consumer will also receive customized
16 energy conservation tips and savings opportunities based on actual energy use.
17 Chai Basic currently supports these three utilities: SCE, Pacific Gas & Electric
18 ("PG&E"), and San Diego Gas & Electric.

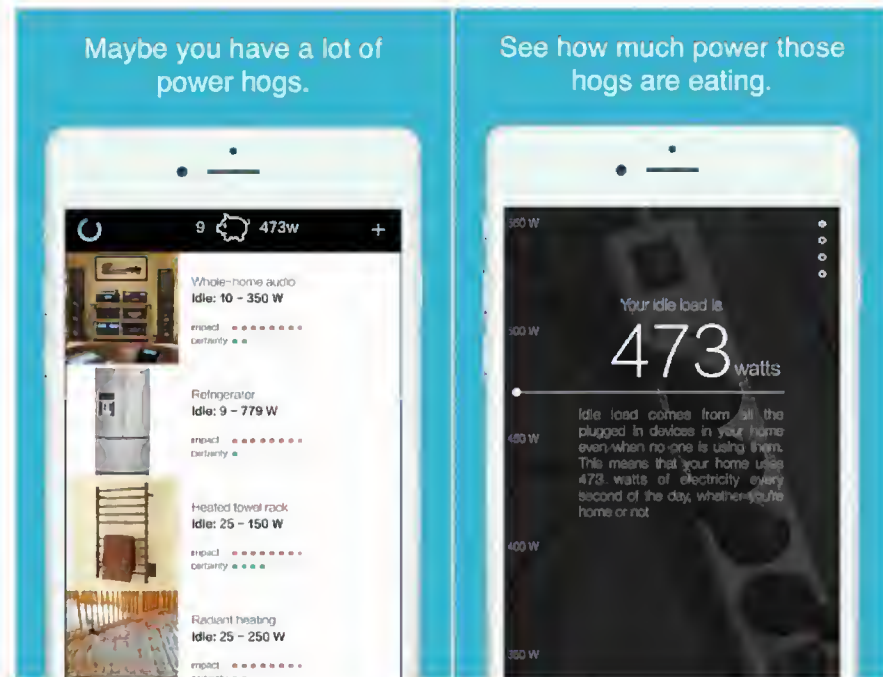
19 **Figure 1: Screenshot of Chai Energy smartphone application (used with permission)**

²⁵ Rebecca Brown, *Bringing It All Together: Design and Evaluation Innovations in the Alameda County Residential Behavior Pilot*, Presentation to the Behavior, Energy and Climate Change Conference (December 8, 2014); *Energy Upgrade Mountain View Final Report*, City of Mountain View, Acterra, and Home Energy Analytics (January 2015).



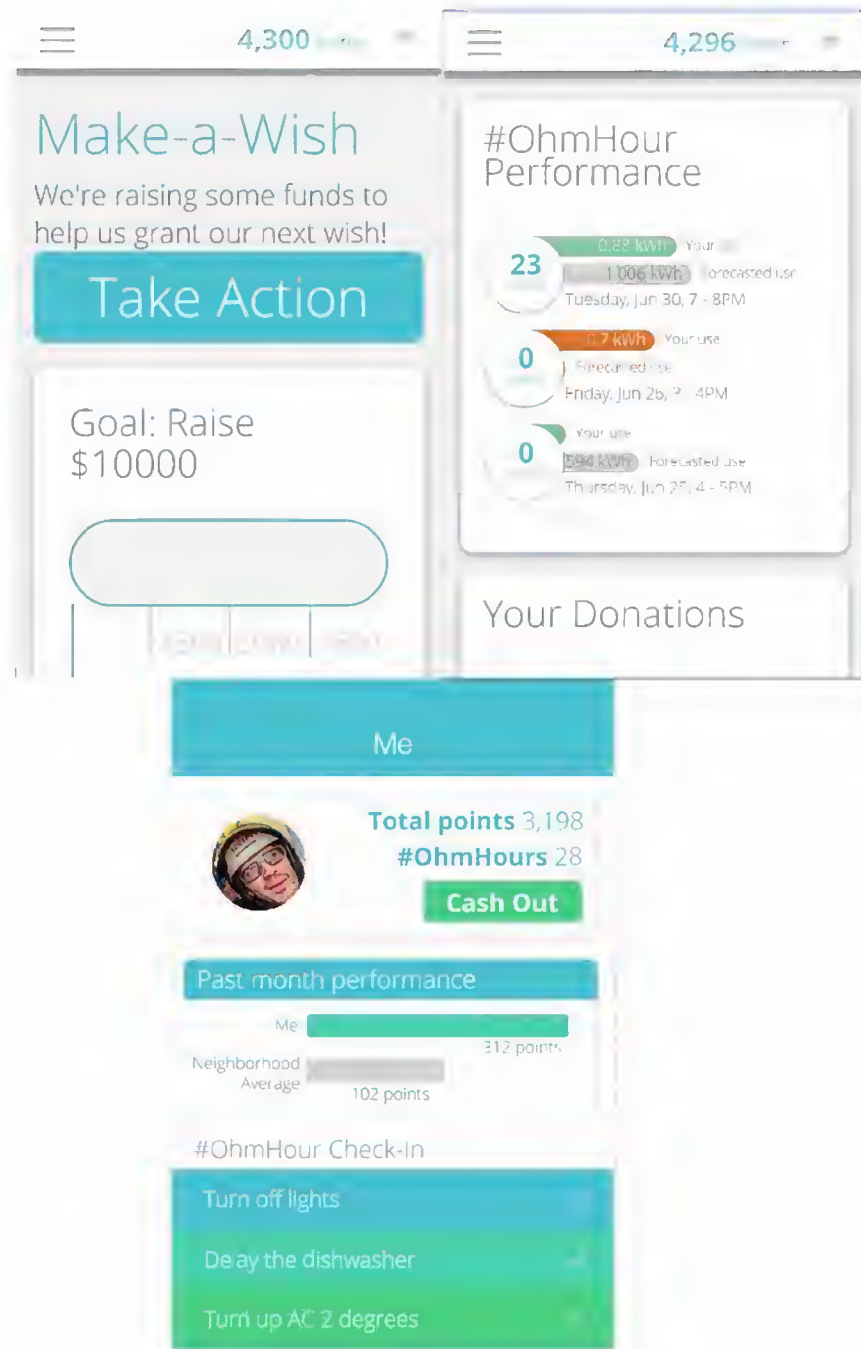
Dr. Power (Home Energy Analytics, Inc.): Dr. Power helps consumers understand home energy use, identify problems, and prescribe solutions. Dr. Power was created by residential energy experts under a grant from the California Energy Commission. Dr. Power is a free app for all Californians and works with PG&E, SCE, and San Diego Gas & Electric. Dr. Power helps users identify energy wasting loads and appliances, reduce consumption, and save energy and money.

1 **Figure 2: Screenshot of Dr. Power smartphone application (used with permission)**



2
3 **OhmConnect, Inc.**: OhmConnect alerts the consumer when he or she
4 should save energy, and pays them to participate. To get started, the consumer (1)
5 connects his or her utility account by authorizing using GBC; (2) participates by
6 turning off lights, the TV, adjusting the thermostat, or holding off on other energy
7 intensive activities; and (3) if he or she has smart devices, connects them and
8 OhmConnect will automate their energy savings. Consumers may refer friends to
9 participate, in which case both the user and the friend earn \$20.

Figure 3: Screenshots of OhmConnect smartphone application (used with permission)



OhmConnect is a free service. If the consumer can't participate, they opt-out of events they cannot or do not want to participate in. OhmConnect needs the

1 advanced meter information to measure energy savings. If the consumer reduces
2 during events, called #OhmHours, OhmConnect is paid by California's electricity
3 market. OhmConnect passes those earnings back to the consumer: to date,
4 OhmConnect has paid its customers more than \$2 million for their participation.
5 Most OhmConnect users choose to receive #OhmHours via text message or email.
6 Some users with wifi thermostats or electric cars have connected their devices to
7 OhmConnect to automate their participation, but that is not required. If consumers
8 are interested in purchasing a smart device, they can visit the OhmConnect Store
9 to see available products that OhmConnect sells and finances through their
10 earnings.

11 **Q. HAS DEP QUANTIFIED OPERATIONAL BENEFITS FROM**
12 **CUSTOMERS RECEIVING ENHANCED ACCESS TO THEIR ENERGY**
13 **USAGE INFORMATION GENERALLY, OR FROM GREEN BUTTON**
14 **CONNECT MY DATA SPECIFICALLY?**

15 A. No. DEP has not quantified these benefits. In its 2017 Smart Grid Technology
16 Plan, DEP cited only operational benefits for the utility in its benefits
17 calculations: reduced expenses for DEP, avoided operations and maintenance
18 costs, avoided capital costs, and increased revenue.²⁶ With regard to GBC
19 specifically, in response to a discovery request, the Company replied, "The
20 Company has not conducted a cost/benefit analysis of Green Button Connect."²⁷ I

²⁶ 2017 Duke Energy Progress Smart Grid Technology Plan. Appendix C, Exhibit A, p. 6, Docket No. E-100, Sub 147 (October 2, 2017).

²⁷ Duke Energy Progress, LLC Response to Environmental Defense Fund Discovery Request No. 1-9 (October 10, 2017) (attached as Exhibit MM-2).

1 strongly recommend the Commission require the Company to quantify these
2 benefits because, as I have argued, they are substantial.

3 **Q. HAS THE NORTH CAROLINA UTILITIES COMMISSION**
4 **CONSIDERED DATA ACCESS BEFORE?**

5 A. Yes. In Docket No. E-100, Sub 147, in an order accepting the Smart Grid
6 Technology Plans of DEP and Duke Energy Carolinas, LLC, the Commission
7 discussed data access. Although the Commission declined at that time to consider
8 rule changes relating to data access, the Commission observed the importance of
9 data access in future AMI deployments:

10 The Commission agrees with EDF's comments that AMI meters,
11 which are able to record consumption data in near real-time, could
12 have an important impact on the residential energy sector....As the
13 utilities expand the use of AMI technologies across North
14 Carolina, the Commission finds that it is imperative that protocols
15 for customer access to energy usage information be properly
16 developed and kept current, consistent with the value proposition
17 of these new technologies.²⁸

18 **Q. DOES DEP'S APPLICATION DISCUSS ANY BENEFITS TO**
19 **CUSTOMERS OF THE INFORMATION COLLECTED BY ADVANCED**
20 **METERS?**

21 A. Yes, but only in very generic statements. DEP's application does not provide any
22 substantive detail. For example, DEP witness Mr. David B. Fountain stated:

²⁸ Order Accepting Smart Grid Technology Plans, p. 22, Docket No. E-100, Sub 147 (March 29, 2017).

- 1 • “And we are starting to roll out smart meters that will help customers
2 more actively manage their consumption...”²⁹
- 3 • “Also, customers increasingly want access to information about their
4 energy usage and tools to manage that energy use and save money.”³⁰
- 5 • “Customers expect greater access to information about their account and
6 energy use, and greater control over that information. Through the
7 consolidation of the older information systems into a new information
8 system, the Company will be able to deliver a customer experience that
9 will simplify, strengthen and advance our ability to serve our customers in
10 this digital age.”³¹

11 Similarly, in response to the question, “How will the metering upgrade
12 directly benefit the Company’s customers?”, Company witness Simpson states:

13 The proposed Metering Upgrade technology is customer-focused;
14 it enables greater convenience, control and transparency over a
15 customer’s energy consumption. AMI-enabled customers will have
16 access to more detailed information about their hourly and daily
17 usage patterns so they can make more informed choices regarding
18 how they use energy.³²

19 **Q. DO YOU BELIEVE THOSE CLAIMS ARE REASONABLE?**

20 A. No. In my opinion, the Company provides very little evidence to substantiate its
21 claim that its proposed AMI upgrade is “customer-focused.” With the exception
22 of a smartphone app that is in a pilot phase, which I discuss below, I believe the

²⁹ Direct Testimony of David Fountain, p. 9.

³⁰ *Ibid.*, p. 10.

³¹ *Ibid.*, pp. 19-20.

³² Direct Testimony of Robert M. Simpson III, p. 29.

1 Company has exaggerated its characterizations of customer benefits – such as
2 customers having “greater control” over their energy use – when, in fact, the AMI
3 system as proposed is merely a more efficient way to bill its customers. For
4 example, the Company provides no detail about how customers will use AMI to
5 control their energy usage. Does AMI allow customers to reduce their energy
6 usage by activating switches of some sort? Will the advanced meter turn on and
7 off devices in the premise? If so, how will the advanced meter interact with
8 customer equipment that is not owned or controlled by the utility? No such
9 information is provided by DEP.

10 Similarly, the Company provides no detail about how customers will have
11 “greater control over [their] information,” although this is touted as one of the
12 primary benefits of AMI. The definition of control is “to exercise authoritative or
13 dominating influence over.” But there is nothing in DEP’s application about how
14 customers can meaningfully exercise their purported control over their
15 information, other than the ability to *see* one’s information on a website in the
16 context of paying a bill. I would posit that “controlling my information” includes
17 the concept of *portability* – the ability to take one’s personal information,
18 including that collected by advanced meters, and take it for one’s own purposes,
19 or elect to have the utility transmit the information to a third party on my behalf,
20 for any purpose I choose. Alas, portability of one’s information does not appear
21 anywhere in DEP’s application. Instead, in response to a discovery request about
22 how the Company thinks about sharing information with third parties, the

1 Company provided a reference to two forms that must be filled out and returned
2 to DEP either by email or by U.S. postal service delivery, along with payment for
3 the cost of \$48 plus \$0.20 per customer for processing, before one's information
4 can be released. For a company that claims to understand that its customers "favor
5 more modern communication channels, where information is almost immediately
6 available,"³³ it is remarkable how un-modern its proposed communication
7 channels are when it comes to empowering ratepayers to exercise meaningful
8 control over the information collected by an expensive advanced metering system.

9 In my experience in 13 other states and Washington, D.C. working on
10 AMI cases before state commissions, it is very common to see utilities propose
11 AMI investments in alluring terms such as "customer empowerment,"
12 "transparency," and "control," but these enticements all too often do not result in
13 tangible benefits to consumers. That is why I have provided concrete
14 recommendations in my testimony so that the laudable goals of customer
15 empowerment and greater control over energy bills are actually achieved.

16 **Q. IS GBC A BEST PRACTICE IN PROVIDING ENERGY USAGE DATA**
17 **TO CUSTOMERS?**

18 A. Yes. Prior to 2013 when California became the first state to mandate GBC, it
19 would not have been possible to say that GBC is a best practice because there was
20 no large-scale deployment in existence. But today, approximately 24 million
21 advanced meters across the United States have, or will soon have, the ability to

³³ Direct Testimony of Retha Hunsicker, p. 8.

1 transmit information to third parties via GBC. The Edison Foundation stated in
2 2013 that GBC would take over as “the norm.” Utilities around the country such
3 as Commonwealth Edison have praised GBC as a best practice, saying, for
4 example:

5 “We are pleased to offer our customers the latest in data analytic
6 technology bringing more opportunities for them to leverage their
7 smart meters and manage daily electric usage...Today, ComEd
8 customers are enjoying record power reliability and they have
9 greater insight and control over their own energy usage through
10 smart meter-enabled programs like Green Button Connect. We are
11 proud to deliver on yet another smart grid promise and look
12 forward to continuing to deliver even more value to our customers
13 in the future,” said Val Jensen, senior vice president of customer
14 operations for ComEd.³⁴

15 **Q. IS GREEN BUTTON CONNECT MY DATA COSTLY TO IMPLEMENT?**

16 A. No. In Colorado, Xcel Energy indicated that the cost to implement GBC in its
17 multi-state service territory was \$1.5-2.0 million.³⁵ This equates to a one-time
18 cost of \$1.00 to \$1.30 per meter for Colorado customers only, but the cost per
19 customer would drop accordingly if other Xcel Energy entities adopt GBC. I
20 submit that GBC’s cost is very modest compared with its potential benefits. As
21 with Xcel Energy, the costs of GBC to North Carolina ratepayers would be further
22 reduced if and when Duke Energy affiliates in other states adopt it.

³⁴ Commonwealth Edison press release (May 24, 2016), available at <http://www.businesswire.com/news/home/20160524006420/en/ComEd-Customers-Green-Light-Share-Energy-Data>.

³⁵ Settlement agreement between Public Service Company of Colorado d/b/a Xcel Energy and Mission:data Coalition, Colorado Public Utilities Commission Proceeding 15A-0789E (April 25, 2016).

1 **Q. IS THERE ANY OTHER STANDARD BESIDES GREEN BUTTON**
2 **CONNECT MY DATA THAT COULD CONSIDERED BE A**
3 **NATIONALLY RECOGNIZED STANDARD AND BEST PRACTICE?**

4 A. I cannot think of one. Perhaps the best answer to this question comes from
5 Consolidated Edison (“ConEd”). In its testimony concerning a 3.5 million
6 advanced meter application that was approved in 2016, ConEd testified:

7 Q. Has the Company [ConEd] identified any alternatives to GBC
8 that should be explored?

9 A. The Company is not aware of any alternatives that provide the
10 functionality, standardization, and customer-driven authorization
11 protocols inherent in GBC...the Company [ConEd] believes that
12 GBC is the appropriate protocol for transferring customer usage
13 information. Development of an alternative would be costly and
14 duplicative, and not based on a nationwide standard.³⁶

15 **B. ACCESS TO REAL-TIME ENERGY USAGE DATA**

16 **Q. PLEASE DESCRIBE IN MORE DETAIL THE ADVANTAGES OF**
17 **ACCESS TO REAL-TIME DATA THROUGH THE HOME AREA**
18 **NETWORK, THE SECOND INTERFACE METHOD YOU ARE**
19 **RECOMMENDING.**

20 A. According to the ACEEE study, programs with real-time, highly-granular data
21 produced the most powerful savings for consumers: As ACEEE observed “the
22 implementation of real-time plus feedback programs is likely to generate the most

³⁶ Customer Operations Panel testimony of Marilyn Caselli, Michael Murphy, Christopher Grant et al., pp. 45-46, New York Public Service Commission Case No. 16-E-0060 (January 29, 2016), available at <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b18A56129-99CB-445B-9FC3-209A60FE9393%7d>.

1 dramatic energy savings across a given community.”³⁷ In the ACEEE study and
2 others, consumers saved up to 12% or more when the data is real-time, compared
3 to lower savings rates from delayed interval data.³⁸

4 Customers have extremely high expectations in 2017: they expect
5 seamless services, push notifications on their smartphones the instant an event
6 occurs, and an effortless interaction with service providers online. Bringing digital
7 experiences from other industries such as personal banking or health and fitness
8 trackers to the energy industry offers tremendous potential to benefit consumers,
9 but only if real-time data are available, and only when such access is
10 technologically consistent across the nation.

11 The exciting trend – made possible by ever cheaper computing power and
12 individual consumption data in standard electronic formats – is the development
13 of customer energy efficiency products and services that are specifically tailored
14 to their own energy use patterns and development of individual strategies and
15 provide prompt feedback.

16 These tailored offerings are more effective than mass-market programs
17 and produce greater energy savings. For example, virtual energy audits that
18 address a customer’s specific energy use can be prepared without a visit to the
19 customer’s home. What used to cost hundreds of dollars with an on-site home

³⁷ Karen Ehrhardt-Martinez et. al. *Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities*, p. iv, American Council for An Energy Efficient Economy (June 2010).

³⁸ *Ibid.*; see also Carrie Armel, Abhay Gupta, Gireesh Shrimali, and Adrian Albert, *Is disaggregation the holy grail of energy efficiency? The case of electricity*, ENERGY POLICY 52, p. 213-234 (January, 2013), available at <http://web.stanford.edu/group/peec/cgi-bin/docs/behavior/research/disaggregation-armel.pdf>.

1 visit can now be performed for \$5 or \$10, or less. Also, comparative
2 benchmarking can be performed to compare the energy use of the customer's
3 appliances against normal energy use for the same appliances using statistical
4 disaggregation and machine-learning techniques.

5 Providing highly granular real-time usage data also enables: (a) diagnosis
6 of large energy loads in real time, by allowing the customer to turn off certain
7 appliances and immediately see their impact; (b) rapid and immediate verification
8 of load reduction, which is required for some demand response applications; and
9 (c) non-intrusive load disaggregation, which is the use of algorithms to
10 differentiate energy loads without measuring them directly, thereby enabling
11 customers to understand how individual *devices* are consuming energy. Statistical
12 disaggregation offers a virtual "itemized bill" and the development of automated,
13 personalized recommendations and alerts, such as "stove left on," or "window AC
14 unit left on with windows open." Hourly interval data can enable very basic
15 disaggregation, but the most powerful disaggregation tools require short-interval
16 data, such as 5- or 10-second data, of the sort generated through direct consumer
17 access to the meter via activation of the HAN radio.

18 **Q. MORE SPECIFICALLY, WHAT IS THE HOME AREA NETWORK?**

19 A. The HAN refers to a communications network in a home (or commercial
20 building) wherein an advanced meter can transmit read-only information about
21 instantaneous or historic energy use to a customer-owned device. Generically
22 speaking, a HAN can enable devices to communicate with one another, such as in

1 home automation applications, and utility meters are not necessarily part of a
2 HAN. But nearly all other utilities that have implemented the HAN in advanced
3 meters have offered the ability to receive read-only, real-time readings directly
4 from the meter, and the control functions from the utility to in-home devices are
5 not supported. The particular wireless protocol that is widely used across the U.S.
6 is known as Zigbee. More specifically, the protocol is Smart Energy Profile v1.1
7 (“SEP1.1”), part of the Zigbee family of standards.

8 **Q. WILL THE HOME AREA NETWORK HARDWARE YOU DESCRIBE**
9 **ADD COSTS TO DEP’S PROPOSAL?**

10 A. No. In my experience, HAN radio hardware is included in virtually all advanced
11 meters available on the market at no additional cost. In a discovery response about
12 the HAN, DEP confirmed this to be the case, saying “The meter hardware
13 proposed for the DEP AMI project are equipped with a Zigbee radio.”³⁹

14 **Q. HAVE OTHER STATES REQUIRED UTILITIES TO PROVIDE THE**
15 **HAN?**

16 A. Yes. Regarding data access on a real-time basis from the HAN, Texas in 2007
17 was the first state to require real-time access to data through the HAN,⁴⁰ and
18 California promulgated a HAN implementation order in 2012 directing that the
19 investor-owned utilities be capable of supporting an unlimited number of HAN

³⁹ Duke Energy Progress Response to Environmental Defense Fund Discovery Request No. 1-3 (Oct 10, 2017) (attached as Exhibit MM-1).

⁴⁰ Rulemaking Relating to Advanced Metering, Texas Public Utility Commission Project No. 31418 (May 10, 2007), available at <http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.121/31418adt.pdf>.

1 deployments.⁴¹ In Illinois, Commonwealth Edison is already enabling use of the
2 HAN radio where it has deployed advanced meters.⁴² These states represent three
3 of the largest four states in energy consumption in the U.S.,⁴³ accounting for 23.4
4 million of the 70 million advanced meters that have been deployed in the U.S.

5 Furthermore, Pennsylvania law requires certain large electric distribution
6 companies to, “with customer consent, make available direct meter access and
7 electronic access to customer meter data to third parties...”⁴⁴ Pennsylvania
8 utilities with advanced meters – along with utilities in the competitive areas of
9 Texas and investor owned utilities in California and Illinois – each implemented
10 the Zigbee Smart Energy Profile 1.1 (“SEP1.1”) standard.

11 National Grid in New York (also known as Niagara Mohawk Power
12 Corporation) also filed an application recently for advanced meters that support
13 Zigbee SEP1.1.⁴⁵ If approved by the New York Commission, National Grid
14 would add 1.7 million advanced meters with SEP1.1 functionality.

⁴¹ Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission’s own Motion to Actively Guide Policy in California’s Development of a Smart Grid System, California Public Utilities Commission Rulemaking No. 08-12-009 (Decision 11-07-056) (July 28, 2011), available at http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/140369.PDF.

⁴² Investigation into the Customer Authorization Required for Access by Third Parties Other Than Retail Electric Suppliers to Advanced Metering Infrastructure Interval Meter Data, Illinois Commerce Commission Case No. 15-0073 (Proposed Order) (December 23, 2015), available at <http://www.icc.illinois.gov/docket/files.aspx?no=15-0073&docId=237768>.

⁴³ U.S. Energy Information Administration, State Energy Profiles, available at http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/rank_use_gdp.html.

⁴⁴ 66 Pa.C.S. § 2807(f)(3) as amended in 2008 by House Bill 2200 (known as “Act 129”).

⁴⁵ Niagara Mohawk Power Corporation d/b/a National Grid Initial Distributed System Implementation Plan, p. 74, New York Public Service Commission Case 14-M-0101 (June 30, 2016).

1 **Q. DOES MISSION:DATA HAVE RECOMMENDATIONS AS TO WHEN**
2 **GBC AND HAN (ZIGBEE SEP1.1) SHOULD BE ENABLED FOR THE**
3 **BENEFIT OF NORTH CAROLINA CONSUMERS?**

4 A. One of the lessons learned from prior deployments in other states is that
5 consumers should be provided access to their energy data concurrently with
6 deployment of advanced meters or as soon as possible. The Company, the North
7 Carolina Utilities Commission, and the consumer all benefit when the AMI
8 deployment is timely and tangibly linked to empowering consumers with easy
9 access to their own real-time data. AMI deployments across the country were
10 often predicated on the notion that customers would be empowered to use energy
11 in the unique ways they want to. Customers are empowered and supportive when
12 an upgrade from a regular meter to an advanced meter comes with the tangible
13 additional benefit for the user and the ability to use new data-driven services.
14 Frustration and confusion have resulted in other states where no actual benefits of
15 AMI were immediately apparent to customers.

16 In Illinois, ComEd is activating the HAN radio upon request as meters are
17 deployed, a process that initially has been manual and will soon be automated. In
18 New York, ConEd plans to activate GBC by the end of 2017 for all customers,
19 even though the AMI rollout will not be completed until 2022. Other utilities in
20 New York pursuing AMI such as Avangrid and National Grid are also required to
21 offer GBC as part of AMI deployment.

22 **Q. PLEASE DESCRIBE WHAT “BRING YOUR OWN DEVICE” MEANS.**

1 A. In relation to the HAN, Bring Your Own Device (“BYOD”) means the capability
2 for a customer to buy any Zigbee-compatible device and connect it to their meter.
3 There are at least a dozen different manufacturers of Zigbee gateways across
4 North America; some include an LCD display for showing real-time usage, while
5 others transmit the information over the customer’s broadband connection to
6 cloud-based software. The key component of BYOD is on the utility’s web portal,
7 and it allows the customer to type in the serial number of their gateway, and
8 another number known as an “installation code” for security purposes, and the
9 utility instantly provisions the device.

10 **Q. HAS DEP PROPOSED TO SUPPORT “BYOD” HAN DEVICES?**

11 A. No. DEP is piloting a HAN gateway from a company called Powerley, but despite
12 proposing to invest \$20.4 million in IT systems relating to AMI, DEP does not
13 mention the critical capability of supporting HAN devices made by multiple other
14 vendors.

15 **Q. IN YOUR VIEW, WHY IS BYOD IMPORTANT?**

16 A. Without BYOD capability, customers are “locked in” to only the HAN devices
17 offered by DEP. That means customers miss out on technological innovations,
18 and lower prices, in the areas of home energy management that are available from
19 a competitive market.

20 DEP’s lack of consideration for BYOD reminds me of an apt historical
21 analogy in the history of telecommunications. Prior to 1968, if customers wanted
22 to purchase a telephone for their home, they could buy from only one company:

1 AT&T. AT&T prohibited any third party telephone from connecting to their
2 network. Telephones at that time were bulky and expensive, though the
3 technology itself was fairly rudimentary. The FCC's 1968 "Carterfone" decision
4 was a landmark development because it established that any manufacturer could
5 make a telephone – not just AT&T – and connect it to the telephone network. In
6 addition to immediately reducing prices on handsets, the Carterfone decision
7 paved for the way for innovations like answering machines, fax machines and
8 dial-up modems in the 1980s.

9 I believe electric utilities pursuing advanced metering are in a very similar
10 situation today. Customers want to be able to access real-time readings from their
11 meter, and many entrepreneurs have sprouted up to meet this demand. Restricting
12 AMI access to a single HAN gateway vendor is just as absurd an idea as buying
13 telephones from a single company. As a result, DEP's lack of BYOD capability
14 inevitably leads to an extension of DEP's monopoly into home energy
15 management, because other vendors are prohibited from accessing the meter. For
16 these reasons, I find that DEP's oversight of BYOD capability very troubling.

17 **III. ACCESS TO BILLING DATA**

18 **Q. PLEASE DESCRIBE YOUR SECOND RECOMMENDATION THAT**
19 **BILLING DATA SHOULD BE AUTOMATICALLY ACCESSIBLE TO**
20 **CUSTOMERS AND AUTHORIZED THIRD PARTIES.**

21 **A.** Most consumers care about dollars, not kilowatt-hours. When third parties have
22 customer authorization to access bill histories, such third parties can help

1 customers estimate cost and energy savings from potential energy efficiency
2 improvements, verify performance against actual energy data, and continue to
3 monitor efficiency and savings over time. Similar to my first recommendation of
4 providing customers with a way to share energy usage data with third parties, I
5 recommend that the Company provide electronic, machine-readable, and
6 automatic transfer of at least 24 months of historical bills to customer-authorized
7 third parties.

8 **Q. WHY DO YOU RECOMMEND AT LEAST 24 MONTHS?**

9 A. Many energy efficiency applications require historic monthly bills through one
10 complete “heating season” and one complete “cooling season” in order to
11 accurately assess energy savings after some retrofit has occurred. A history of 24
12 months ensures that seasonal and meteorological effects can be properly
13 accounted for.

14 **Q. WHAT TECHNICAL STANDARD DO YOU RECOMMEND FOR**
15 **EXCHANGING BILLING DATA WITH AUTHORIZED THIRD**
16 **PARTIES?**

17 A. I recommend GBC because it has an extension that supports billing histories.
18 Every line item of a bill can be captured with the same XML standard for securely
19 transmitting energy consumption data. Line items of bills can include complex
20 terms like meter charges, demand charges, time of use charges, fuel charges,
21 program charges, franchise fees, taxes, and other information. All of this
22 information is important to companies that provide energy management and cost

1 management services. A wide variety of billing line items and billing structures
2 are accommodated in the GBC technical standard.

3 **Q. PLEASE DESCRIBE THE IMPLICATIONS IF THE COMPANY DOES**
4 **NOT PROVIDE ELECTRONIC BILLING HISTORY AS YOU HAVE**
5 **RECOMMENDED.**

6 A. Without standardized, machine-readable access to historical billing data,
7 customers will not be able to access new services that depend upon streamlined,
8 zero-cost electronic accessibility, including, but not limited to: cost analysis
9 software, automated bill audits that search for overcharges, financial
10 benchmarking services against peers, and even certain financial products that
11 allow customers to borrow money for efficiency improvements. It will also be
12 difficult for customers to know whether investments they have made in
13 distributed energy resources are paying off because distributed energy resource
14 (“DER”) companies cannot easily access the customer’s bills.

15 For commercial customers, including multifamily property owners, the
16 lack of software-readable billing histories means that many such customers turn to
17 the market and pay for bill digitization services. An industry in its own right, bill
18 digitization serves the needs of many multi-site building owners or managers who
19 must capture, understand, benchmark, and ultimately pay dozens, hundreds or
20 even thousands of bills from different utilities across the U.S. every month. The
21 inclusion of 24 months of historical billing data, as well as ongoing bills as they
22 are generated, in GBC would significantly benefit these customers by avoiding

1 the costs of bill digitization services and drastically reducing the time needed to
2 process data and launch solutions for new clients.

3 While larger commercial customers have access to bill digitization to
4 manage their utility expenses and track usage, these types of solutions are
5 prohibitively expensive for smaller customers such as nonprofit low income
6 housing organizations, small businesses, and individual owners and tenants. These
7 customers cannot afford bill digitization and instead often use inefficient, paper-
8 based processes. For these customers, access to detailed machine readable bill
9 data means that it will become easier to monitor and pay their bills, save money,
10 and access new services.

11 Organizations such as property owners with a nation-wide presence want
12 to perform analysis for properties across states, utility companies, and types of
13 tariffs, for example by studying demand charges and peak kW demand usage.
14 While these categories can be interpreted from bills, this is difficult and unreliable
15 as utility companies use different names for usages and charges, sometimes
16 between different tariffs of the same utility company. Including standard
17 categorizations in GBC bill data will significantly decrease the time and money it
18 takes to do this type of analysis and increase data quality for the users of these
19 services. In addition, the bill digitization process can introduce inaccuracies,
20 because optical character recognition and other techniques performed to extract
21 data from printed bills and bill images are not always perfect. Customers would

1 benefit by having accurate representation of their bills available from the
2 Company in an electronic, automated fashion.

3 **Q. ARE THERE OTHER BENEFITS OF PROVIDING BILLING DATA IN**
4 **AN ELECTRONIC, MACHINE-READABLE, AUTOMATED MANNER?**

5 A. Digital bill data will open up the possibility for third party suppliers to provide
6 richer, digital context to customers, for example via links to explain rates, or
7 instructional videos for how to weatherize a single family home. With machine-
8 readable bill data, software can be developed for vision-impaired customers to
9 hear or feel their bills, giving them easy access to this information. Access to
10 digital bill data will also make it easier for customers to use tailored third party
11 services to pay their bill. With these types of services, customers can, for
12 example, aggregate their bills and payments by property or by geographic area.

13 **Q. DO ANY OTHER UTILITIES ACROSS THE U.S. PROVIDE BILLING**
14 **HISTORIES TO THIRD PARTIES IN AN AUTOMATED FASHION?**

15 A. PG&E provides historical billing information as part of its GBC offering. PG&E
16 customers can choose to securely transmit their usage data alone, or in
17 conjunction with, their 48-month billing history to a third party. Also in
18 California, SCE, and San Diego Gas & Electric have stated they will support
19 historical billing data as their GBC implementations are enhanced over time. New
20 York utilities ConEd and Orange and Rockland Utilities will provide historical
21 billing data as part of “Phase 2” of their GBC implementation in 2019.

IV. ACCESS TO UTILITY RATE DATA

Q. PLEASE DESCRIBE YOUR THIRD RECOMMENDATION THAT UTILITY RATE INFORMATION SHOULD BE PUBLISHED IN STANDARDIZED, MACHINE-READABLE FORM.

A. Tariff information – including the prices that consumers pay for electricity and natural gas – is publicly available today for consumers with default electric service, since the Commission approves rates. However, owing to the complexity of modern rate structures, projecting a given customer’s bill with consumption data in kilowatt-hours, given an approved rate in PDF form, is extremely difficult. It requires detailed knowledge of how the tariff works, a close reading of the legalistic language, and faithful translation of the text into correct mathematical operations to calculate a price in dollars. With time-of-use (“TOU”) rates, careful analysis becomes even more important because customer bills can vary widely depending on when the consumption occurred. Re-packaging customer tariffs in a publicly-accessible, machine-readable form, rather than a PDF file, would thus make rate structures much more accessible and usable to distributed energy resource (“DER”) providers.

Fortunately, much work has already been done in this area around standardization. The National Renewable Energy Laboratory (“NREL”) has already developed the Utility Rate Database and last year engaged with California utilities on a pilot program to develop a uniform, web-based repository of machine-readable tariffs. This digital repository already exists today and contains

1 over 40,000 rates from utilities across the country. But the rates are kept up to
2 date only with the significant effort of NREL. If the Company's approved rates
3 were maintained in the NREL Utility Rate Database, it would be possible for
4 software applications to immediately and instantly create accurate cost estimates
5 of energy efficiency or distributed energy. With more than 3,000 retail electric
6 utilities in the United States, each of which may maintain dozens or hundreds of
7 rate structures, it would be extraordinarily costly for DER providers to accurately
8 maintain an up-to-date tariff database with nationwide coverage. There is also the
9 issue of "reinventing the wheel" where each DER provider has its own
10 mathematical interpretation of the rate structure. Without a central repository, cost
11 savings estimates from DER providers may lack the accuracy and rigor important
12 for household decision-making across the state of North Carolina. It is not
13 uncommon to see savings estimates from some companies based upon a flat rate
14 per kilowatt-hour (i.e., \$0.15/kWh) that masks the realities of TOU intervals,
15 seasonal variations, tiers, demand charges, taxes and the like. Thus a key benefit –
16 both for consumers and DER providers – of a machine-readable central repository
17 of tariffs kept up to date by the utilities is the accuracy of cost information
18 provided to the marketplace at large.

19 NREL already has a head start with a draft machine-readable format and
20 thousands of tariffs in its Utility Rate Database. Also, the utility's billing system
21 already calculates dollar amounts routinely. What I recommend is that DEP be
22 required to re-package the calculations of bills into a publicly-available form –

1 both downloadable and accessible through an Application Programming Interface
2 (“API”) provided by NREL – to make those accurate calculations available to
3 DER providers.

4 **V. EASE OF USE AND THE CUSTOMER AUTHORIZATION PROCESS**

5 **Q. PLEASE DESCRIBE YOUR FOURTH RECOMMENDATION THAT THE**
6 **CONSENT PROCESS SHOULD BE ELECTRONIC AND EASY TO USE.**

7 A. The Company evidently has a complex IT infrastructure. In my experience as a
8 software entrepreneur, it is easy for any IT manager to be overwhelmed by
9 technical requirements and implementation challenges in a large-scale project and
10 lose sight of the end customer. How does the customer actually share his or her
11 energy use or billing data with a third party? Where in the process of using the
12 Company’s web portal will customers get confused and abandon the authorization
13 process? Can the customer’s tasks be completed in the fewest number of steps?
14 How long does it take the customer to complete a common function, and can that
15 time be reduced? These are the questions that are often forgotten when deadlines
16 and technical challenges loom, but they are nevertheless essential because the
17 benefits from GBC or the HAN, and thus many benefits from DEP’s AMI
18 deployment, won’t be realized if customers can’t easily interact with the system
19 and authorize the third party service provider of their choice. I note that
20 Amazon.com is famous for its “1 click” purchase button. Customers are more
21 likely to follow through with an online transaction – whether buying a product
22 from an online retailer, or an energy management service – if the fewest number

1 of clicks is required. This lesson of simplicity should be taken to heart by the
2 Company so that the maximum amount of users can take advantage of new
3 technological offerings.

4 To quantify the impact of streamlining the online process for customers, a
5 study by EnergyHub found dramatically different rates of consumer participation
6 in demand response programs – 3% vs. 40% – among eligible customers when the
7 enrollment forms were electronic, dramatically simplified and consumers could
8 instantly sign up.⁴⁶ EnergyHub and other innovative companies rely on a
9 streamlined process for their customers to share energy usage data, as well as to
10 enroll in certain utility programs. The impact of ease of use can positively impact
11 utilization of these offers by literally an order of magnitude. This is the reason
12 why the California Public Utilities Commission recently ordered a “click-
13 through” website enrollment process in which electronic signatures are accepted
14 and “the click-through process shall begin and end on the third-party demand
15 response provider’s website.”⁴⁷ More detailed technical recommendations and
16 best practices can also be found in a report from the California “click-through”
17 working group dated October 12, 2016,⁴⁸ and as memorialized in the California
18 Commission’s August, 2017 resolution.⁴⁹

⁴⁶ *Optimizing the demand response program enrollment process*, EnergyHub, Inc. (April, 2016), available at <http://www.energyhub.com/blog/optimizing-demand-response-enrollment>

⁴⁷ California Public Utilities Commission Decision D.16-06-008, Order Para. 1 (June 6, 2016), available at <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M163/K294/163294060.PDF>.

⁴⁸ Status Report Ordered by the Assigned Commissioner’s Office During Discussions at the October 5, 2017 Click-Through Workshop, Application No. 14-06-001, 14-06-002 and 14-06-003 (October 12, 2016)

⁴⁹ California Public Utilities Commission Resolution E-4868 (August 25, 2017), available at <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M194/K746/194746364.PDF>.

1 I recommend the Company should be required to hold stakeholder
2 meetings to discuss and implement these recommendations for improving the
3 GBC experience in North Carolina.

4 **Q. PLEASE FURTHER DESCRIBE YOUR FOURTH RECOMMENDATION**
5 **THAT THE CONSENT PROCESS SHOULD BE ELECTRONIC AND**
6 **EASY TO USE.**

7 A. In the case of GBC, the Company should provide a streamlined online sharing
8 process that includes a minimum number of clicks. It is also very important for
9 the Company to adhere to the authorization process element of the GBC standard
10 known as OAuth 2.0. OAuth 2.0 is the standard process adopted by Facebook,
11 Google, Twitter, LinkedIn, and many other online services use for securely
12 authenticating a customer's identity. Strict adherence to the standard is important,
13 because consumers have a familiarity with OAuth 2.0 from other online services
14 used throughout daily life, and deviations from what customers expect will result
15 in confusion and reduced utilization of GBC. My previous recommendation is that
16 the Company be required to attain periodic certification from an independent third
17 party known as the Green Button Alliance. Such certification will help ensure an
18 optimal customer experience, since OAuth 2.0 is incorporated into the GBC
19 standard.

20 I further recommend that there should be alternative methods of
21 authenticating users who do not want an online utility account. In this scenario,
22 the utility can ask for the customer account number and other identifying

1 information required as proof of the customer's authorization. But the customer
2 would not have to create an online account, which is a barrier for many people
3 who already have hundreds of online accounts for different services and do not
4 wish to create new ones.

5 **VI. SECURITY AND PRIVACY**

6 **Q. DO YOU HAVE RECOMMENDATIONS TO ENSURE SECURITY?**

7 A. Adoption and implementation of solutions based on nationally recognized open
8 standards offer the best opportunity to ensure robust security. One of the values of
9 widely adopted standards is that larger numbers of experts from across the
10 country have studied, tested, and evaluated the standards, and probed them for
11 vulnerabilities. The Company can take advantage of that work for the benefit of
12 consumers by adhering to widely adopted national standards.

13 With regard to real-time data, SEP1.1 is a secure protocol that should be
14 used by the Company. Any security concerns raised by activation of the HAN
15 radio with Zigbee SEP1.1 are not of sufficient magnitude to deny North Carolina
16 consumers and the North Carolina economy a significant percentage of the
17 benefits of the AMI investment with access to real-time energy usage data.
18 SEP1.1 uses symmetric encryption keys and strong 128-bit Elliptic Curve
19 Cryptography ("ECC") to prevent an eavesdropper from listening to the messages
20 broadcast from the meter. Significant time and effort from the Zigbee Alliance –
21 whose board of directors includes representatives from Philips, Samsung
22 SmartThings, Itron, Landis+Gyr, Huawei, and Comcast – have ensured that the

1 latest security best practices are incorporated into SEP1.1. As described above,
2 numerous other utilities across the country have implemented SEP1.1 after having
3 vetted the standard and concluded it is secure.

4 I note that California, Illinois, Pennsylvania, and Texas and Illinois have
5 all ordered utilities to activate the HAN radio for the benefit of consumers. I have
6 carefully researched this issue and I am not aware of any security breaches or
7 successful attacks on utility systems or consumers through the HAN interface.

8 **Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

9 A. Yes.

**Duke Energy Progress
Response to
Environmental Defense Fund Interrogatory Request
Interrogatory Request No. EDF 1-3**

Docket No. E-2, Sub 1142

**Date of Request: September 25, 2017
Date of Response: October 10, 2017**

☐

CONFIDENTIAL

☒

NOT CONFIDENTIAL

Confidential Responses are provided pursuant to Confidentiality Agreement

The attached response to Environmental Defense Fund Interrogatory Request No. 1-3, was provided to me by the following individual(s): Brian Hughes, Smart Grid Planning Manager, Grid Solutions, Regulatory Planning, and was provided to NC Public Staff under my supervision.

Heather Smith
Deputy General Counsel
Duke Energy Progress

Environmental Defense Fund
Interrogatory Request No. 1
DEP Docket No. E-2 Sub 1142
Item No. 1-3
Page 1 of 1

EDF Interrogatory 1-3

Request:

When Duke deploys smart meters, are the meters equipped with a Zigbee radio?

Response:

The meter hardware proposed for the DEP AMI project are equipped with a Zigbee radio.

**Duke Energy Progress
Response to
Environmental Defense Fund Interrogatory Request
Interrogatory Request No. EDF 1-9**

Docket No. E-2, Sub 1142

**Date of Request: September 25, 2017
Date of Response: October 10, 2017**

☐

CONFIDENTIAL

☒

NOT CONFIDENTIAL

Confidential Responses are provided pursuant to Confidentiality Agreement

The attached response to Environmental Defense Fund Interrogatory Request No. 1-9, was provided to me by the following individual(s): Joseph R. Thomas, Director, Enhanced Customer Solutions, Customer Solutions, and was provided to NC Public Staff under my supervision.

Heather Smith
Deputy General Counsel
Duke Energy Progress

Environmental Defense Fund
Interrogatory Request No. 1
DEP Docket No. E-2 Sub 1142
Item No. 1-9
Page 1 of 1

EDF Interrogatory 1-9

Request:

What investigation has Duke performed to determine the costs and benefits of deploying Green Button Connect?

Response:

The Company has not conducted a cost/benefit analysis of Green Button Connect.